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IX.—*History and Classification of the known Species of* Spongilla. By H. J. Carter, F.R.S. &c.

[Plates V. & VI.]

The freshwater sponge has been known from a very early period, although perhaps only first publicly noticed in 1696, by Leonard Plukenet, in the following way, viz. "Spongia fluviatilis anfractuosa perfragilis ramosissima" (apud Pallas, No. 4 *). Linnæus, in 1745 (No. 2), described two species

* Publications to which reference is made in the following communication:—

1.—1696. Plukenet, Leonard. (Brit. Bot.) Almagestum, p. 356, tab. 112. f. 3, "Spongia fluviatilis anfractuosa perfragilis ramosissima."
2.—1745. Linnæus. Flora Suecica, Spec. Pl., ed. 1, sp. 11. *Spongia fluviatilis*; ib. sp. 10. *Spongia lacustris.*
3.—1758. Linnæus. Systema Naturæ, ed. x.
4.—1766. Pallas. Elench. Zoophytorum. *Spongia fluviatilis*, No. 231, p. 384.
5.—1816. Lamarck. Anim. sans Vertèbres, t. ii. p. 98.
6.—1826. Grant, Robert. "On the Structure and Nature of the *Spongilla friabilis*," Edin. Phil. Journ. vol. xiv. p. 270.
7.—1835. Gervais, P. "Les Éponges d'eau douce," Ann. des Sc. Naturelles, n. s. t. iv. p. 254.
8.—1839. Meyen, F. J. F. "Beiträge zur nähern Kenntniss unseres Süsswasserschwammes," Müller's Archiv, 1839, S. 83, apud Lieber-

under the names respectively of "*Spongia lacustris*" and "*S. fluviatilis*" (apud Pallas), observing in his 'Systema Naturæ' of 1766, ed. xii. p. 1299, that "Autumnali tempore in hujus poris sparsis globulos cærulescentes magnitudine seminum thymi &c. observavit C. Blom, M.D.;" so that Linnæus then was not only acquainted with the existence of the freshwater sponge, but also with the presence of the little globular bodies (*globuli*) in it, to which our attention will be more particularly given by-and-by, under the term of "statoblasts;" while Pallas, also, in 1766, in his diagnosis of "*Spongilla fluviatilis*," stated, "Massæ interdum aut crustæ informes in stagnantibus aquis; in fluentis forma ramosissima" (No. 4, p. 384). Thus the two species of the present day were foreshadowed both in character and nomenclature.

Subsequently much was written on the subject by various authors, and the name "*Spongia*" more than once changed (see "Literature" apud Johnston, No 10); but that of "*Spon-*

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kühn (No. 14, p. 7); Microscopic Journ. vol. i. p. 42, 1841 (No. 10, p. 154); Valentin's 'Repertorium,' 1840 (No. 21, vol. ii. p. 341).

9.—1840. Hogg, J. "Observations on the *Spongilla fluviatilis*," Linn. Soc. Trans. vol. xviii. pt. 3.

10.—1842. Johnston, G. History of British Sponges &c. *Spongilla*, pp. 149–163.

11.—1848. Carter, H. J. "Notes on the Species, Structure, and Animality of the Freshwater Sponges in the Island of Bombay," Ann. & Mag. Nat. Hist. ser. 2, vol. i. p. 303.

12.—1849. Carter, H. J. "A Descriptive Account of the Freshwater Sponges in the Island of Bombay, with Observations on their Structure and Development," ibid. vol. iv. p. 81, pls. iii., iv., and v.

13.—1854. Carter, H. J. "Zoosperms in *Spongilla*," ibid. vol. xiv. p. 334, pl. xi.

14.—1856. Lieberkühn, N. "Beiträge zur Entwickelungsgeschichte der Spongillen," Archiv f. Anat. u. Physiologie, Heft i. u. ii. pp. 1–19 (Jan.).

15.—1856. Lieberkühn, N. "Beiträge" &c. (Nachtrag), ibid. Heft iv. pp. 399–414, Taf. xv. (May).

16.—1856. Lieberkühn, N. Id. ibid. Heft v. pp. 496–514, Taf. xviii. figs. 8, 9.

17.—1857. Carter, H. J. "On the Ultimate Structure of *Spongilla* &c.," Ann. & Mag. Nat. Hist. ser. 2, vol. xx. p. 21, pl. i.

18.—1859. Carter, H. J. "On the Fecundation of the Volvoces, &c. (*Spongilla*)," Ann. & Mag. Nat. Hist. ser. 3, vol. iii. pp. 12–15, pl. i. figs. 12–14 (Jan.).

19.—1859. Carter, H. J. "On the Identity in Structure and Composition of the so-called 'Seed-like Body' of *Spongilla* with the Winter-egg of the Bryozoa; and the Presence of Starch-granules in each," ibid. vol. iii. p. 331, pl. viii. (May).

20.—1863. Bowerbank, J. "Monograph on the Spongillidæ," Proc. Zool. Soc. London, Nov. 24, pl. xxxviii.

gilla," instituted for the genus by Lamarck in 1816 (No. 5), has taken precedence of all the rest, whereby we now have *Spongilla fluviatilis* and *S. lacustris*.

It was not, however, until the improvements of the microscope ushered in an era of minuter observation that *Spongilla* was more particularly examined, when Dr. Grant (my kind friend and able teacher) published his "Observations" in 1826 (No. 6). After this, Meyen, in 1839, pointed out that the crust of the sphærula or seed-like body (statoblast) was composed of vertically placed spicula 1-250th to 1-200th of a millim. broad, at whose extremities, near the circumference, more or less toothed little disks are formed (Pl. VI. fig. 11, *a*, *b*), and further that, "besides the larger siliceous spicula within the substance of the sponge, there exist more delicate ones of 1-16th to 1-10th of a millim. long, having upon their surface little points which elongate as their age increases" (apud Johnston, No. 10, p. 154, footnote). Here

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21.—1866. Bowerbank, J. Monograph of the British Spongiadæ, vol. ii. pp. 339–344, *Spongilla fluviatilis* and *S. lacustris*; ib. vol. i. p. 262, spicula of the ovaries of *Spongilla*; pl. ix. figs. 201–227, pls. xxii. and xxiii. figs. 217–322 (figures of the "ovaries").

22.—1867. Gray, J. E. "Notes on the Arrangement of Sponges," Proc. Zool. Soc. London, May 9, p. 550, &c. (Potamospongia, classification of).

23.—1867. James-Clark, H. J. "*Spongiæ ciliatæ* as *Infusoria flagellata*," Journ. Boston Soc. Nat. Hist. vol. i. pt. 3, pls. ix. and x.

24.—1868. Carter, H. J. "On a Variety of *Spongilla Meyeni* from the River Exe, Devonshire," Ann. & Mag. Nat. Hist. ser. 4, vol. i. p. 247.

25.—1870. Bowerbank, J. Monograph of the British Spongiadæ, vol. iii. pls. lix. and lx.

26.—1874. Carter, H. J. "On the Nature of the Seed-like Body of *Spongilla*, &c," Ann. & Mag. Nat. Hist. ser. 4, vol. xiv. p. 97.

27.—1875. Carter, H. J. "Notes Introductory to the Study and Classification of the Spongida," ibid. vol. xvi. p. 1, &c.: Potamospongida (pp. 187, 190, and 199).

28.—1877. Dybowski, W. "Ueber Spongillen der Ostsee-Provinzen," Sitzungsber d. Naturf. Gesellsch. zu Dorpat, Bd. iv. Heft 2, 1876, p. 258, Heft 3, 1877, p. 527.

29.—1878. Schulze, F. E. "Untersuchungen über den Bau und die Entwicklung der Spongien. Die Gattung *Halisarca*," Zeitschrift f. wiss. Zoologie, Bd. xxviii.

30.—1879. Metschnikoff, E. "Spongiologische Studien," ibid. Bd. xxxii. p. 349, Taf. xx.–xxiii.

31.—1879. Carter, H. J. "On the Nutritive and Reproductive Processes of Sponges," Ann. & Mag. Nat. Hist. ser. 5, vol. iv. p. 374.

32.—1880. Dybowski, W. "Studien über die Spongien des Russischen Reiches mit besonderer Berücksichtigung der Spongien-Fauna des Baikal-Sees," Mém. Acad. Imp. d. Sc. de St. Pétersbourg, 7e série, t. xxvii. no. 6.

evidently the minute spicules with "toothed little disks" and "little points" respectively belonged to *Spongilla fluviatilis* and *S. lacustris*. Meyen also stated that the seed-like bodies or sphærulæ of *Spongilla* are "essentially distinct from the sporangia of Algæ, and are similar to what are denominated the *winter-eggs* of polypes" (No. 10, *l. c.*), which having endeavoured myself to illustrate and confirm in 1859 (No. 19), I finally adopted the term "statoblast" (No. 19, p. 340). Lastly, Mr. John Hogg, in 1840, demonstrated beyond question that these "seed-like bodies," or statoblasts, *germinated* in water, and thus reproduced the *Spongilla* (No. 9).

In 1842, Johnston published his work on the British Sponges (No. 10), from which the 'Monograph on the British Spongiadæ' of Dr. Bowerbank is chiefly compiled; and in Johnston's work an epitome of all that had been made known up to the time was given, not only of *Spongilla*, but of every other species of the British sponges that had been noticed, together with descriptions and illustrations from actual observation, not only of these but of many others which he added to them; so that this book is a *sine quâ non* to the student.

A few years after this, brings us to a period in which, besides the reproduction of *Spongilla* through the "seed-like body," one through *sexual elements* was also sought for and discovered. Thus, in 1856, Lieberkühn discovered and figured the ovum of *Spongilla*, together with the spermatozoa (Nos. 14, 15, and 16), which, as regards the ovum, Grant had done in the marine sponges in 1826 (Edin. New Phil. Journ. vol. ii. p. 133, pl. ii. figs. 27–29), and, as regards the spermatozoa, F. E. Schulze confirmed, in 1878, in the marine species *Halisarca lobularis* (No. 29). I take no account of my own observation of "zoosperms in *Spongilla*" in 1854 (No. 13), although the absence of the so-called "ear-like appendages" &c. in the figures of them &c. now seems to indicate that they were such, although in the interval I have doubted this, because the fact was not substantiated after the satisfactory manner in which it was subsequently demonstrated by the sagacious Lieberkühn.

Thus, then, in addition to the "seed-like body" in *Spongilla*, it was shown that the freshwater sponges could be propagated by elements of sexual reproduction like those of the marine sponges.

Shortly after this, my own observations (Nos. 17 and 18), coupled with those of James-Clark in 1867 (No. 23), established the "animality" of *Spongilla*, together with the form

of the animal itself, for which, in 1872, I proposed the name "spongozoon" ('Annals,' vol. x. p. 45).

Finally Lieberkühn, observing what had been pointed out by Meyen in 1839, viz. that the seed-like body of *Spongilla* was partly composed of "little toothed" amphidisks, and that besides these there were others with "little points" or spines on their surface ("rauhen etwas gekrümmten"), made these the distinctive characters of *Spongilla fluviatilis* and *S. lacustris* respectively (No. 16, pp. 510, 511). This was confirmed by Bowerbank in 1863 (No. 20, p. 7, pl. xxxviii. fig. 1, *b*, *c*, and p. 24, *ib.* fig. 14, *c*); and good representations of these sponges were given by him in 1870 (No. 25, pls. lix. and lx.); but unfortunately the amphidisk or birotulate is omitted in the former, viz. that illustrating *S. fluviatilis*. Descriptions of the two species, as well as illustrations of the seed-like bodies and their spicules respectively, were also published by Dr. Bowerbank in 1866 (No. 21).

Thus the two species of *Spongilla*, hitherto doubtfully distinguished from ignorance of these more decided differences, were firmly established.

Having premised all the circumstances connected with the history of the freshwater sponge (*Spongilla*) that are necessary for the present occasion, we find that they are quite as much advanced physiologically as those of the marine species; and although the latter must ever be by far the most numerous, from the great extent of area producing them, yet, when we remember how few known species of *Spongilla* there are compared with the comparatively large area of freshwater which they may be inferred to inhabit, while the localities of the area in which they have been found are, with the exception of Europe, "few and far between," and as yet from Africa none at all have been described, it may also be inferred that hereafter a great many more species will be added to those with which we are at present acquainted, while the latter are already sufficiently numerous and diversified to render a classification of them desirable for further advancement.

This classification should, of course, be based on some peculiar and persistent characters which may yet admit of modified addition; and as we have seen that until Meyen had pointed out the form and presence of spicules in the seed-like body, no reliable distinction existed between *Spongilla fluviatilis* and *S. lacustris*, so we may assume that this may be anticipated throughout the family. And such is the fact; hence the classification which I am about to propose will be based chiefly on the spicules of the statoblast.

Up to the present time no species of marine sponge has been found to present a statoblast; while those of the freshwater sponge, although *specimens* are often without any (like the mycelium of "dry rot," *Merulius lachrymans*, which may destroy the woodwork of a whole mansion without putting forth its fructification in more than half a dozen places), might be assumed to be capable of producing them in every instance. So here we possess a sharp line of demarcation between the marine and freshwater sponges; for I have examined the type specimen (now in the British Museum) supposed by Dr. Bowerbank to show the existence of the seed-like body in his marine genus *Diplodemia* (No. 25, pl. lxx. fig. 12 and No. 21, vol. i. pl. xxiii. fig. 234, and vol. ii. p. 357), and find that this is nothing more than an insignificant portion of egg-bearing *Isodictya* adherent to the valve of a *Pecten*.

As already stated, Meyen considered the "seed-like body" of *Spongilla* to be equivalent to the "winter egg" of the polyp (Polyzoa); and, as before stated, I have endeavoured to confirm this view by parallel description and illustration (No. 19); while Prof. Allman having proposed the name "statoblast" for the winter egg of the freshwater Polyzoa (Monograph, Ray Society, 1856), must be my reason for calling the seed-like body the "statoblast" of *Spongilla*.

Describing the statoblast generally, it may be said to be in size about as big as a pin's head, varying in this respect, not only with the species but in the individual. For the most part it can be seen with the naked eye, and therefore does not differ much in size from the ova and embryos (swarmspores) of both the freshwater and marine sponges. In form it is more or less globular or elliptical (Pl. V. figs. 1 and 4), and of a whitish colour when fully developed, with a hole either lateral or terminal on the surface, generally at the bottom of an infundibular depression which leads to the interior (fig. 1, *h*, and 4, *e*, &c.). If we now make a vertical section through the hole or aperture of one of these bodies when dry (for this is the best time) with a sharp thin knife, we may observe that it consists of an internal, globular, axial cavity filled with a soft waxy substance of a yellowish colour, like that of dried yelk of egg (fig. 1, *a*, &c.); which substance, on microscopic examination, when swollen out in water, will be found to be composed of a great number of extremely thin, transparent, spherical sacs, filled respectively with minute germinal matter consisting of transparent germs or cellulæ of different sizes; the whole enclosed by a delicate, globular, transparent, investing membrane (fig. 1, *b*) slightly protruding at the aperture (fig. 1, *i*), and presenting a reticulated

appearance like that of vegetable cell-structure when compressed *minus* any granules (fig. 12, *f*). (For further detail respecting these parts, see Nos. 12, 17, and 19.) Outside this follows a comparatively thick, translucent, homogeneous membrane, seemingly composed of chitine, whose amber colour being reflected through the "axial" substance gives the latter in the section a deeper tint than it is found to possess when separate; this will be called the "chitinous coat" (fig. 1, *c*). Then comes another kind of coat, composed, in two instances, of cell-structure, which is almost evident under a doublet (fig. 3, *d* and *i*), as will be seen hereafter, but in the rest of a white granular substance (fig. 2, *a*) that will presently be more particularly described, which can only be resolved into such by a very high compound power; and this will be called the "crust" (fig. 1, *d*); it appears to afford a floating property (like cork) to the statoblast, but varies very much in thickness, not only according to the amount of its development, but according to the species. The "crust," again, is charged with, or accompanied by, minute spicules of different forms, variously arranged according to the species, which will be found by-and-by, as before stated, to yield the chief characters of our classification (fig. 1, *g*, and fig. 2, *b*, *c*). At the "aperture," of course, these two coats are deficient, while the interior or chitinous one is prolonged into it by a tubular extension, generally in proportion to the thickness of the "crust" (fig. 1, *h*).

Meyen thought that the substance of the "crust" was composed of "carbonate of lime having a cellular structure" (No. 10, p. 154); but in no instance have I found it to effervesce with acids, while, on the contrary, after boiling it for some time in strong nitric acid it leaves a floccular residue, which may be assumed to be a colloid form of silica, unless it be undissolved tissue. As before stated, in some instances the cell-structure, being comparatively large, is perfectly evident, while in others it is only resolvable under a very high magnifying-power (at least 450 diameters), when it may be termed "microcell-structure," presenting under ordinary circumstances a white granular appearance, which, filling up the intervals between the spicules, imparts to the fully developed statoblast the light colour before mentioned. It floats in water, and is very much like "pith," without apparent cell-structure, is unaffected by liquor potassæ, and untinged by iodine, while before the blowpipe it burns off without leaving any perceptible residue. The floating-power of this substance is very considerable; for it keeps on the surface the whole of the internal contents, which swell out and sink to the bottom the moment they are liberated by sec-

tion in water, while the remnants of the crust themselves continue to float with the greatest pertinacity. Still, although in most instances where the statoblast is fully developed it forms a thick coat, yet in others it can hardly be traced even under the microscope after the fully developed statoblast has been mounted in balsam; while it must not be forgotten that, as its development is progressive, it may be as *un*traceable at an early period in one as in the other.

Lastly, there is often a distinct layer of spicules which are more like those of the skeleton than those of the statoblast, but sufficiently differentiated by their peculiarities from both to show that they do not belong to either (Pl. VI. fig. 8, *l*, *n*); and these form a very distinct capsular covering to the statoblast, in which probably it was originally developed, and thus separated from its neighbours.

Generally the statoblasts are situated towards the base or first-formed portions of the *Spongilla*, either fixed to the object on which the sponge may be growing, or more or less scattered throughout its structure. The details of their development may be found in the papers to which I have last alluded; while, as this is also progressive, they often present themselves in a collapsed hemispherical state, without the crust, when the chitinous coat, being uncovered, gives them an amber colour, and thus their appearance generally is that of a different kind; but, as before stated, the statoblast when fully developed is, especially in the fresh state, globular, and, in proportion to the thickness of the crust, more or less white in colour. Yet there is a crustless spherical form, wherein too the aperture may be multiplicate—that is, double, triple, or even quintuple (Pl. V. fig. 5, *c c c c c*)—as first noticed in another species by Gervais (No. 7); with which also there appear to have been statoblasts that contained two or three others of the same kind presenting the same structure, the same composition, and the same yellowish colour (apud Johnston, No. 10, p. 154); so that, as before stated, the statoblast, although generally globular or elliptical, may have these forms modified in a variety of ways, as indeed may be seen in those which I have figured in Plates V. and VI.

Now, as the statoblast has so far been found in nearly all the freshwater sponges that have been described, and never in the marine ones, while the form of the skeleton-spicule is not only always acerate but almost always more or less alike in all, it follows from the latter being of little or no specific value that the statoblast, which is different in all, at least in the form of its spicules, must become the basis of the most reliable classification; and therefore I shall use its characters for what in this respect I may hereafter have to propose.

No attempt to classify the freshwater sponges had been made up to the publication of the late Dr. J. E. Gray's "Notes" in 1867 (No. 22, p. 491), when my dear old friend (alas! now only dear to memory) made them the seventh order in his "proposed" arrangement of the Spongida generally, under the terms "Potamospongia," family "Spongilladæ," with the following genera, viz.:—1. *Ephydatia*; 2. *Dosilia*; 3. *Metania*; 4. *Acalle*; 5. *Drulia*; 6. *Eunapius*; and 7. *Spongilla*; adding Dr. Bowerbank's *marine* species *Diplodemia* as an eighth genus—an incongruity arising from the misconception of Dr. Bowerbank to which I have already alluded. If Dr. Gray's "Notes" had been based on direct knowledge of the species of *Spongilla* themselves, and not on Dr. Bowerbank's "Monograph" (No. 20), it might have been unnecessary now to propose a different arrangement. It is enough to state of this "Monograph" that Dr. Bowerbank therein calls the statoblasts "ovaries," and in speaking of them in *Spongilla gregaria* (No. 20, p. 15) thus expresses himself—"The gregarious habit of these ovaries," &c.—to show the fallacies that might arise from such loose phraseology. But setting aside this and the like (for there is much to redeem it), I have had before me, in addition to the publications under reference, the actual specimens, while going through the late Dr. Bowerbank's collections for the British Museum (where they now are); and it has been from examination of these type specimens, together with my own from the island of Bombay, which were described, illustrated, and published long before Dr. Bowerbank's "Monograph of the Spongillidæ," that I have been induced to propose the following classification.

As may have been observed, in my "Notes introductory to the Study and Classification of the Spongida," in 1875 (No. 27), I found it necessary to make the freshwater sponges the fifth family of my sixth order of the Spongida generally, under the name of "Potamospongida," with a single group, at present named "Spongillina." Hence so far they will stand thus:—

Class SPONGIDA.

Order VI. HOLORHAPHIDOTA.

Char. Possessing a skeleton whose fibre is entirely composed of proper spicules bound together by a minimum of sarcode. Form of spicule variable.

Family 5. **Potamospongida.**

Freshwater Sponges.

Group 19. *Spongillina.*

Char. Bearing seed-like reproductive organs called "statoblasts."

Genera: 1. *Spongilla*; 2. *Meyenia*; 3. *Tubella*; 4. *Parmula*; 5. *Uruguaya.*

Spongilla.

Gen. char. Skeleton-spicule acerate, smooth, curved, fusiform, pointed, sometimes more or less spined or more or less inflated in the centre; sometimes accompanied by flesh-spicules. Statoblast globular, crust thick, thin, or absent altogether, accompanied by or charged with minute acerates (Pl. V. fig. 5, *b b*, *d*, &c.), smooth or spined according to the species, arranged tangentially.

* *Minute acerates smooth.*

1. *Spongilla Carteri*, Bk.

Spongilla Carteri, Bk., No. 20, p. 31, pl. xxxviii. fig. 20; provisionally *S. friabilis*, Lam., No. 12, p. 83, pl. iii. fig. 3.

Massive, sessile. Colour greenish or faint whitish yellow. Structure fragile, crumbling. Skeleton-spicule smooth, fusiform, curved, gradually † sharp-pointed. Statoblast globular; aperture infundibular; crust composed of pyramidal columns of dodecahedral or polyhedral cells, hexagonal in the section, regularly arranged one above another, in juxtaposition, perpendicularly to the outside of the chitinous coat on which they rest; surrounded by a layer of minute, fusiform, curved, and gradually sharp-pointed, smooth acerates (No. 19, pl. viii. figs. 1–3).

Loc. Bombay.

2. *Spongilla paupercula*, Bk.

Spongilla paupercula, Bk., No. 20, p. 32, pl. xxxviii. fig. 21.

Coating and branching. Skeleton-spicule curved, fusiform,

† "Gradually," in contradistinction to "abruptly" sharp-pointed (See Pl. VI. figs. 14 and 15 respectively).

sharp-pointed, smooth. Statoblast globular; spicules curved, fusiform, gradually sharp-pointed, smooth.

Loc. Water-pipes of Boston &c., U.S.

Obs. Mr. Thomas H. Higgin, F.L.S., of Liverpool, kindly sent me a specimen from the same locality, viz. the water-pipes of Boston, which, when examined, proved to have a similar skeleton-spicule, among which there are a number of minute, curved, fusiform, sharp-pointed acerates so like the flesh-spicules of *Spongilla lacustris* that, in the absence of statoblasts, I am led to consider it the same species; and if I am right, then the spicules of the statoblast should be spined, while those of *S. paupercula* were of the "same form as those of the skeleton, but not more than half their size;" so these would be more like statoblast-spicules of *S. Carteri*. My description of *S. paupercula*, Bk., is an abbreviated one of that given by Dr. Bowerbank himself (*l. c.*).

3. *Spongilla navicella*, Carter, n. sp.
(Pl. V. fig. 4, *a–g*.)

Sponge unknown. Skeleton-spicule curved, fusiform, smooth, gradually sharp-pointed. Statoblast adherent to the twig on which the sponge had grown; globoelliptical (fig. 4); aperture terminal, infundibular (fig. 4, *e*); no apparent crust; chitinous coat (fig. 4, *c*) encased with a dense layer of minute, stout, short, thick, more or less curved, fusiform, smooth acerates, variable in size, becoming so short internally (that is, where they are in immediate contact with the chitinous coat) as to be trapezoidal, or like a little boat or "cocked hat," according to the direction in which they are viewed; arranged tangentially, crossing each other (fig. 4, *d* and *g*).

Loc. River Amazons.

Obs. A few of the statoblasts were found on a small twig in company with *S. reticulata*, Bk., and *S. paupercula*, Bk., in the Bowerbank collection. They bear evidence of the existence in the river Amazons of a species of *Spongilla* whose entirety is as yet unknown; and it is very probable that a further search there would find many such.

** *Minute acerates spined.*

4. *Spongilla lacustris*, Linn.

Spongilla lacustris, Bk., No. 20, p. 24, pl. xxxviii. fig. 14; also No. 21, vol. ii. *l. c.* and vol. i. p. 342; also No. 25, pl. lx. and No. 16, pp. 510, 511.

S. lacustris auctt.

Branched; branches long, round, and sharp-pointed. Colour

dark brown. Structure fibrous. Skeleton-spicule (Pl. VI. fig. 14) curved, fusiform, gradually sharp-pointed, smooth, sometimes more or less spiniferous. Flesh-spicule thin, curved, fusiform, gradually sharp-pointed, spined throughout. Statoblast when fully developed globular; aperture infundibular; crust composed of granular cell-structure, charged with more or less curved, minute, stout, fusiform, sharp-pointed acerates covered with stout recurved spines, arranged tangentially or centrifugally, like the lines of a so-called "engine-turned" watch-case.

Loc. England and Europe generally; North America; Asia, Lake Baikal (*Dybowski*).

5. *Spongilla alba*, Carter.

Spongilla alba, Carter, No. 12, p. 83, pl. iii. fig. 4; also No. 20, p. 25, pl. xxxviii. fig. 15.

Massive, spreading, subbranched. Structure fragile, tomentose. Colour whitish. Skeleton-spicule curved, fusiform, gradually sharp-pointed, smooth. Flesh-spicule thin, curved, fusiform, covered with spines, longest in the centre, where they are vertical and obtuse. Statoblast globular; aperture infundibular; crust thick, white, composed of granular cell-structure charged with minute, thick acerates, which are curved, cylindrical, round at the ends, covered with spines (especially about the extremities, where they are longest and much recurved), arranged tangentially, intercrossing each other like the lines of an engine-turned watch-case.

Loc. Bombay.

Obs. The spicules of the statoblast here, as well as in *Spongilla lacustris*, are considerably stouter, more curved, cylindrical, and more coarsely spined than the flesh-spicules of the sponge generally.

6. *Spongilla cerebellata*, Bk.

Spongilla cerebellata, No. 20, p. 27, pl. xxxviii. fig. 16.

This *Spongilla*, which appears to me to be only a variety of the foregoing species, differs from it chiefly in the absence of the "flesh-spicule," in addition to what Dr. Bowerbank has mentioned (*l. c.*).

Loc. Central India, Aurungabad.

7. *Spongilla multiforis* *, Carter, n. sp.
(Pl. V. fig. 5, *a–d.*)

Massive, incrusting. Colour dark brown. Structure fra-

* *multiforis*, with many doors or openings (in allusion to the plurality of the "apertures").

gile, fibrous, like that of *S. lacustris*. Skeleton-spicule curved, fusiform, gradually sharp-pointed, smooth, often inflated in the centre. Statoblast spherical (fig. 5); apertures in plurality (one to five) (fig. 5, *c c c c c*), on a level with the chitinous coat (fig. 5, *a*), as there is no apparent crust; surrounded by a layer of minute, curved, fusiform, sharp-pointed, spinous acerates, which are in contact with the chitinous coat, arranged tangentially (fig. 5, *b* and *d*).

Loc. Chiluk-weyuk Lake, British Columbia, lat. 49° 10′ N., long. 121° 22′ W.

Type specimen in the British Museum, presented by Dr. Lyall. Register no. 64. 8. 11. 1–10; running no. 239.

Obs. As the statoblasts, although very numerous, are all empty, it is probable that the germinal matter has passed out of them, and therefore that they are only the effete remains of this organ, although still covered by the statoblast-spicules, as represented in the illustration.

8. *Spongilla Lordii*, Bk.
(Pl. VI. fig. 13, *a–f*.)

Spongilla Lordii, Bk., No. 20, p. 28, pl. xxxviii. fig. 17.

Sessile, incrusting reeds (fig. 13, *f*); surface even. Structure fragile, crumbling. Colour light brown. Skeleton-spicule curved, fusiform, gradually sharp-pointed, smooth, often inflated in the centre. Statoblast hemispheroidal, flat bottle-shaped, forming a single layer in juxtaposition round the reed, underneath the sponge, with the aperture upwards (figs. 13 and 13 *f*); chitinous coat hemispheroidal (fig. 13, *a*); aperture prolonged from the summit by a short tubular extension (fig. 13, *b*, *c*); colour dark amber, followed by a thin granular crust charged with small curved, fusiform, spined acerates, round at the extremities, arranged tangentially (fig. 13, *d* and *e*).

Loc. Lake Osogoos, Cascade Mountains, British Columbia.

Type specimen in the British Museum. Register no. 68. 8. 17. 1–7; running no. 211. Presented by J. K. Lord, Esq.

9. *Spongilla nitens*, Carter, n. sp.
(Pl. V. fig. 3, *a–k*, and Pl. VI. fig. 18.)

Form of sponge unknown to me. Structure reticulate; fibre rigid, composed of bundles of spicules united by transparent colourless sarcode, which in the dried state gives it a hardness and vitreous appearance like that of *Spongilla corallioides*, Bk. Skeleton-spicule curved, cylindrical, smooth, sometimes very slightly inflated in the centre and at the extremities, which are round (Pl. VI. fig. 18). Statoblast glo-

bular (fig. 3); aperture infundibular (fig. 3, *g*); crust composed of pyramidal columns of dodecahedral or polygonal cells, hexagonal in the section, regularly arranged one above another, in juxtaposition (fig. 3, *d* and *i*), perpendicularly to the outside of the chitinous coat (fig. 3, *c*), on which, by the intervention of a layer of the statoblast-spicules (fig. 3, *e*), they rest, surrounded by a layer of minute, fusiform, curved acerates thickly spined, especially over the ends, where the spines are longest and recurved (fig. 3, *k*), arranged tangentially (fig. 3, *f*); the same kind of layer immediately round the chitinous coat, where the spicules appear to be intermixed with the lower cells of the crust, leaving the latter free between the two (fig. 3, *e*).

Loc. Unknown.

Obs. Of this species I can state nothing more than that a small fragment appeared in the Bowerbank collection labelled "*Spongilla*, new species, from the Jardin des Plantes." While it affords another instance of the crust of the statoblast being composed of apparently hexagonal cell-structure like that of *Spongilla Carteri*, the rigidity and vitreous appearance of the skeletal structure, if not the form of the spicule also, allies it to *Spongilla corallioides*, Bk., which will be seen hereafter to come from Uruguay. Finally, as this peculiar rigidity of the skeletal structure has in addition only been found in two species of *Spongilla* (viz. *S. Batesii* and *S. reticulata*, Bk.) from the river Amazons, it may be assumed that *S. nitens* also comes from South America. The presence of a layer of statoblast-spicules on the inside as well as on the outside of the crust will be seen by-and-by to occur also in the statoblast of *Parmula* (*Spongilla*) *Batesii*.

Meyenia*.

Gen. Char. Skeleton-spicule acerate, curved, fusiform, sharp-pointed, smooth, sometimes more or less spined, or more or less inflated in the centre. Statoblast globular or elliptical; crust composed of the granular structure mentioned, charged with birotulate spicules, *i. e.* spicular bodies which consist of a straight shaft terminated at each end by a disk, even or denticulated at the margin (Pl. V. fig. 6, *h*, &c.), arranged perpendicularly around the chitinous coat, so that one disk is applied to the latter, while the other forms part of the surface of the statoblast (fig. 6, *e*).

* "*Meyenia*," after Meyen, who first pointed out that the statoblast was partly composed of birotulate or amphidiscal spicules (*l. c.*).

* *Margin of disks even.*

1. *Meyenia erinaceus.*

Spongilla erinaceus, Ehr. apud Lieberkühn, No. 15, p. 509.

Of this species Lieberkühn says, "Zeichnet sich durch Nadeln aus, welche auf ihrer Oberfläche mit kleinen Stacheln versehen sind;" but the spinous character of this spicule *here* does not appear to be such a valuable character, in a specific point of view, as the disks of the birotulate spicule of the statoblast, which Lieberkühn describes in the following page to be without denticulation, and represents as umbonate with even circular margin and short shaft (No. 15, Taf. xv. fig. 31).

Loc. River Spree, Berlin.

Obs. This sponge appears otherwise, *i. e.* in structure and spiculation, to be like *Meyenia fluviatilis.* I do not know where Ehrenberg has described it.

2. *Meyenia Leidii.*

Spongilla Leidii, Bk., No. 20, p. 7, pl. xxxviii. fig. 2.

Thin, sessile, coating. Surface tuberculated, minutely hispid. Structure friable, crumbling. Skeleton-spicule curved, fusiform, abruptly sharp-pointed, sparsely spiniferous, becoming much smaller and more spined round the statoblasts. Statoblast globular, aperture infundibular; crust composed of granular substance charged with birotulate spicules possessing very short shafts and evenly margined smooth umbonate disks, both of which have the margins more or less everted or turned outwards (that is, *from* the statoblast), arranged perpendicularly on the chitinous coat.

Loc. Schuylkill river, Pennsylvania.

3. *Meyenia gregaria.*

Spongilla gregaria, Bk., No. 20, p. 14, pl. xxxviii. fig. 7.

Sponge unknown. Skeleton-spicule cylindrical, stout and rather short. Form of statoblast not mentioned; crust charged with birotulate spicules composed of a short thick shaft terminated at each end by a simple umbonate disk with even circular margin, arranged perpendicularly to the chitinous coat. Spicules in the immediate neighbourhood of the statoblast cylindrical, slightly curved, and abundantly spiniferous, varying considerably in size.

Loc. River Amazons.

Obs. Having no specimen of this species to refer to, I got Mr. Stuart Ridley, F.L.S., of the British Museum, to examine the mounted specimens of *Spongilla gregaria* and *S. reticulata*,

Bk., for me, since, although I have taken my diagnosis from Dr. Bowerbank's descriptions and illustrations (*l. c.*), still, as the skeletal spiculation of the former is almost precisely that of the latter, which covered the twig on which the statoblasts *alone* of *S. gregaria* were found, to the extent of "five inches," it seemed to be by no means impossible that the spiculation of the two species might have been confounded. Mr. Ridley's drawings are confirmatory of this possibility; and thus the skeletal spiculation given by Dr. Bowerbank to *S. gregaria* becomes nearly identical with that of the foregoing species, viz. *S. Leidii*, Bk.; but while the ends of the spicules are abruptly *pointed in the latter*, they are *equally round* in *S. reticulata* and those stated by Dr. Bowerbank to characterize the skeletal spicule of *S. gregaria*.

Undoubtedly we have the same sparsely spined skeleton-spicule becoming smaller and thickly spined in the immediate neighbourhood of the statoblasts in *S. Leidii*, *S. gregaria*, and *S. reticulata*, together with absolutely smooth skeleton-spicules in all three, if those assigned to *S. gregaria* by Dr. Bowerbank be the right ones. Thus the skeletal spicules and the spicules of the statoblasts in *S. Leidii* tending to the characters of those assigned to *S. gregaria*, in spite of the roundness of the ends of the skeletal spicules in the latter, seems to point out that the spinous element existed in both, and that generally they are closely allied; but, after all, it does not satisfy our doubt as to whether the round-ended spicules did not belong to *S. reticulata*. Further observation is required to decide this.

*** Margin of disks denticulated.*

4. *Meyenia fluviatilis.*

Spongilla fluviatilis, Bk., No. 20, p. 7, pl. xxxviii. fig. 1; also No. 21, vol. ii. p. 339; vol. i. pl. xxii. figs. 317–319; and No. 25, vol. iii. pl. lix.
Spongilla fluviatilis auctt.

Massive, lobate. Structure friable, crumbling. Colour light yellow-brown. Skeleton-spicule curved, fusiform, gradually sharp-pointed, smooth, often spined and often centrally inflated, Statoblast globular; aperture infundibular; crust thick, composed of the granular or microcell-substance, charged with birotulates whose umbonate disks are deeply and irregularly denticulated (Pl. VI. fig. 11, *a*, *b*), arranged parallel to each other and perpendicular to the chitinous coat.

Loc. England and Europe generally.

Obs. Here, as elsewhere, in proportion to the thickness of the crust is the length of the infundibular aperture, which is partly lined by a tubular extension of the chitinous coat.

Spongilla Meyeni, Carter.

Spongilla Meyeni, Carter, No. 12, p. 84; and No. 20, p. 10, pl. xxxviii. fig. 4.

Loc. Bombay.

Spongilla fluviatilis, var. *Parfitti*, Carter.

Spongilla fluviatilis, var. *Parfitti*, Carter, Ann. & Mag. Nat. Hist. 1868, vol. i. p. 247; and Bowerbank, 1870, No. 25, p. 298, pl. lxxxvi. figs. 5–14.

Loc. River Exe, Devonshire.

Obs. Having specimens of all three of these sponges now before me, I cannot help thinking that the occasional differences of spiculation in one may be seen in the other, and therefore that *S. Meyeni* and *S. fluviatilis*, var. *Parfitti* are mere varieties of *S. fluviatilis* = *Meyenia fluviatilis*, nobis. Of the two specimens of *S. fluviatilis*, var. *Parfitti*, that I have mounted, nearly all the skeleton-spicules in one are smooth, and nearly all those in the other are spiniferous, which shows what an admixture of these two kinds of spicules *may* exist in *Meyenia fluviatilis*. It is convenient here to allude to

Spongilla sceptrifera, Bk.

Spongilla sceptifera, Bk., No. 25, p. 300, pl. lxxxvi. figs. 15–17.

Loc. Reservoir, Exeter.

Obs. This pretended *new* species is no "new species" at all, but probably *S. fluviatilis*, as the statoblast would have proved if any had been present; for *S. fluviatilis* grows abundantly in the same locality, and the characteristic spicule represented by Dr. Bowerbank (*l. c.* fig. 17) is nothing more than a detached frustule of the diatom *Asterionella*, like *A. formosa* (Pritchard's Infusoria, ed. 1861, pl. iv. fig. 17), which, in its entirety (that is, with the frustules arranged in a radiated ring) as well as separated, abounds on the *surface* of the type specimen (which was kindly given to me by Mr. E. Parfitt, of Exeter), but *not in the interior*. It at once appeared to me that such a form of spicule could not belong to any species of *Spongilla*; and, indeed, I have never seen any thing identifiable with it either in the freshwater or marine sponges. Mr. Parfitt found the specimen, and sent part of it to Dr. Bowerbank, who immediately seized upon it as a new species of *Spongilla*.

5. *Meyenia Capewelli*.

Spongilla Capewelli, Bk., No. 20, p. 9, pl. xxxviii. fig. 3.

Massive, sessile. Surface even, lobular. Structure friable,

crumbling. Skeleton-spicule curved, fusiform, abruptly sharp-pointed, smooth, sometimes inflated in the centre. Statoblast globular; aperture infundibular; crust thick, composed of granular microcell-substance charged with birotulate spicules consisting of a straight shaft somewhat inflated in the centre, terminated at each end by an umbonate disk of equal size, whose margin is irregularly crenulo-denticulate, and whose surface is granulated towards the circumference often in lines running towards the centre, mixed with faint radiating lines generally coming from that point, arranged perpendicularly, with one disk resting on the chitinous coat and the other forming part of the surface of the statoblast.

Loc. Lake Hindmarsh, Victoria, Australia, lat. 35° 30′ S., long. 141° 40′ E.

6. *Meyenia plumosa.* (Pl. V. fig. 6, *a-k.*)

Spongilla plumosa, Carter, No. 12, p. 85; No. 20, p. 11, pl. xxxviii. fig. 5.

Massive, lobate. Structure feathery, fibrous, friable. Colour greenish or light brown. Skeleton-spicule curved, fusiform, gradually sharp-pointed, smooth. Flesh-spicule stelliform, consisting of a variable number of arms of various lengths radiating from a large, smooth, globular body; arms spined throughout; spines longest at the ends, so as to present a capitate appearance, and recurved generally (fig. 6, *k*); the whole varying from a simple, spinous, linear spicule to the stellate form first mentioned, thus modified by the size and presence of the globular inflation and number of arms developed from the centre of the former; abundant in all parts of the structure, but especially in the neighbourhood of the statoblasts. Statoblast ellipsoidal (fig. 6); aperture lateral, infundibular (fig. 6, *f*); crust, which is thick and composed of granular microcell-substance (fig. 6, *d*), charged with birotulate spicules (fig. 6, *e*) consisting of a long, straight, sparsely spiniferous shaft whose spines are large, conical, and perpendicular, terminated at each end by an umbonate disk of equal size, whose margin is irregularly denticulated, with the processes more or less turned inwards (fig. 6, *h*, *i*), arranged perpendicularly, with one disk resting on the chitinous coat and the other forming part of the surface of the crust (fig. 6, *e*).

Loc. Bombay.

Obs. The variety in the minute spiculation generally of this species renders it perhaps the most beautiful in this respect that has yet been discovered.

7. *Meyenia Baileyi.*

Spongilla Baileyi, Bk., No. 20, p. 13, pl. xxxviii. fig. 6.

Coating, surface smooth. Structure friable, crumbling. Skeleton-spicule curved, subfusiform, gradually sharp-pointed, smooth. Flesh-spicule minute, curved, fusiform, gradually sharp-pointed, covered with erect obtuse spines throughout, extremely small towards the extremities, and extremely long and perpendicular about the centre of the shaft. Statoblast globular; aperture infundibular; crust, which is thick and composed of granular cell-substance, charged with birotulate spicules consisting of a long, straight, sparsely spiniferous shaft whose spines are large, irregular in length, conical and perpendicular, terminated at each end by an umbonate disk of equal size deeply but regularly denticulated, whose processes are claw-like and turned inwards, arranged perpendicularly, with one disk resting on the chitinous coat and the other forming part of the surface of the statoblast.

Loc. New York. In a stream on the Canterbury Road, West Point.

Obs. This seems to be the North-American representative of the Bombay species, viz. *Meyenia plumosa*, but with globular, not elliptical, statoblast.

8. *Meyenia anonyma*, Carter, n. sp.
(Pl. VI. fig. 12, *a–f.*)

Sponge unknown. Statoblast flask-shaped (fig. 12); aperture terminal (fig. 12, *c*); composed of a membranous coat striated longitudinally (fig. 12, *a*), supporting a reticulation (fig. 12, *b*) consisting of extremely minute, erect, conical processes with their sharp ends inwards, and presenting in the centre of each interstice, especially towards the fundus, a short, thick, somewhat hourglass-shaped spicule whose outer end is more or less denticulated, and whose inner one is inserted into the striated coat (fig. 12, *d*, *e*). Investing membrane of the germinal matter transparent, presenting the usual polygonal reticulation without granules, like compressed cell-structure (fig. 12, *f*).

Loc. River Amazons.

Obs. Of this statoblast, which is indicative of an undescribed species of *Spongilla*, I can state nothing more than that its presence appeared to me to be an accidental occurrence on the surface of another species which had grown over the surface of a leaf sent to me by Dr. Dickie.

Tubella*.

Gen. char. Skeleton-spicule curved, fusiform, sharp-pointed or rounded at the extremities, smooth or spined. Statoblast globular or elliptical; aperture lateral or terminal; crust composed of the granular microcell-substance mentioned, charged with inæquibirotulate spicules—that is, a little trumpet-shaped spicule having a straight shaft which is smooth, spined or inflated, or both, terminated by a large disk at one, and a small one or an umbonous, circular, marginally spined head at the other end (Pl. V. fig. 7, *i*); the former applied to the chitinous coat, and the latter forming part of the surface of the statoblast.

1. *Tubella paulula.* (Pl. VI. fig. 10, *a–c.*)

Spongilla paulula, Bk., No. 20, p. 15, pl. xxxviii. fig. 8.

Thin, incrusting. Surface even. Structure fragile, crumbling. Colour now brown. Skeleton-spicule curved, fusiform, abruptly sharp-pointed, spiniferous or smooth. Statoblast globular; aperture sunken, infundibular; crust composed of granular microcell-structure charged with two kinds of inæquibirotulates, one form of which is much stouter than the other, and consists of a straight shaft passing by trumpet-like expansion into the large disk, which often has radiating lines, and abruptly terminating in the other, which is only one fourth of the diameter of the former (Pl. VI. fig. 10, *a*, *b*); the other form similarly constructed, but more delicate, with the shaft inflated towards the large disk, and the smaller one much less in proportion than in the larger form (fig. 10, *c*); the forms not mixed but confined to their statoblasts respectively; arranged perpendicularly, with the large disk resting on the chitinous coat, and the smaller one forming part of the surface of the statoblast.

Obs. Although the skeleton-spicule in Dr. Bowerbank's illustration is smooth, it is stated in his diagnosis (p. 16, *l. c.*) to be "entirely spined," which is the case generally, but not always; so that the artist must have taken for the illustration one of the smooth ones.

2. *Tubella spinata*, Carter, n. sp.
(Pl. VI. fig. 9, *a–m.*)

Thin, coating, spreading. Structure fragile, crumbling. Colour light brown. Skeleton-spicule curved, fusiform, gradually sharp-pointed, smooth or spiniferous. Flesh-spicule minute, curved, fusiform, thin, gradually sharp-pointed,

* *Tubella*, a little *straight* trumpet.

covered with perpendicular spines, which are longest about the centre (fig. 9, *m*). Statoblast elliptical, flask-shaped; aperture terminal (fig. 9, *f*); crust thick, composed of granular microcell-substance (fig. 9, *d*) charged with inæquibirotulate spicules (fig. 9, *e*) consisting of a straight shaft, inflated near the small end, and passing by trumpet-like expansion into the large disk, sparsely spined (fig. 9, *h*); disk circular, smooth, with even margin (fig. 9, *i*), small end consisting of a circular convex head, regularly denticulated on the margin with eight or more conical processes, which are slightly inclined towards the shaft (fig. 9, *k*, *l*); arranged perpendicularly, so that the disk rests on the chitinous coat and the head forms part of the surface of the statoblast (fig. 9, *e*).

Loc. River Amazons. On a leaf sent to me by Dr. Dickie in 1878.

3. *Tubella reticulata.* (Pl. VI. fig. 8 *a–n*, and fig. 16.)
Spongilla reticulata, Bk., No. 20, p. 17, pl. xxxviii. fig. 9.

Elliptical, or fusiform when growing round the immersed small branches of trees. Structure *extremely rigid*, reticulate, terminating in thorn-like processes on the surface. Colour light sea-green when growing in clear water. Skeleton-spicules curved or bent, cylindrical or subfusiform, rounded at the ends, absolutely smooth or sparsely spiniferous (Pl. VI. fig. 8, *m*, and fig. 16), becoming more so towards the statoblasts, where they are not more than half the size, thickly spined, and in this shape form a distinct capsular layer around each of those organs (fig. 8, *l*, *n*). Statoblast elliptical, ovoid (fig. 8); aperture terminal (fig. 8, *f*); crust composed of granular microcell-substance (fig. 8, *d*) charged with inæquibirotulate spicules (fig. 8, *e*) consisting of a straight shaft passing by trumpet-like expansion into the large disk, with two or more spines about the centre, and furnished with a ring-like inflation towards the disk (fig. 8, *h*); disk circular, smooth, with even margin, which is somewhat recurved (fig. 8, *i*), small end consisting of a circular umbonate head regularly denticulated on the margin with 6–8 conical processes, which are slightly inclined inwards or towards the shaft (fig. 8, *k*); arranged perpendicularly, so that the disk rests on the chitinous coat, and the head or small end forms part of the surface of the statoblast (fig. 8, *e*).

Loc. River Amazons.

Obs. The skeletal structure of this species, although of the same rigid nature and general character as that of *Parmula Batesii* and *P. Brownii*, to be hereafter mentioned, is more reticulated and not nearly so coarse as in the latter.

4. *Tubella recurvata.* (Pl. V. fig. 7, *a–l.*)

Spongilla recurvata, Bk., No. 20, p. 18, pl. xxxviii. fig. 10.

Sessile, coating. Surface even. Structure fragile, crumbling. Colour brownish. Skeleton-spicule curved, fusiform, abruptly sharp-pointed, smooth or spiniferous. Statoblast globular (Pl. V. fig. 7); aperture infundibular (fig. 7, *g*); crust thick, composed of granular microcell-substance (fig. 7, *d*), charged with inæquibirotulate spicules (fig. 7, *e*) consisting of a delicate, straight, smooth shaft passing by trumpet-like expansion into the large disk, which is circular, smooth, saucer-shaped, inverted, with even margin, curved towards the shaft, and abruptly terminating in the other, which is only one eighth of the diameter of the disk (fig. 7, *i*), arranged perpendicularly with the large disk resting on the chitinous coat, and the small one somewhat *within* the surface of the crust (fig. 7, *e*); surrounded by a capsule of short thick spicules (fig. 7, *f*), consisting of a straight smooth shaft, slightly inflated in the centre, and terminated at each end by an equal-sized head, which is prominently umbonate, with circular margin regularly divided into eight conical teeth slightly incurved (fig. 7, *k*, *l*), arranged perpendicularly around the statoblast, with one end free and the other adherent to the surface of the crust (fig. 7, *f*).

Loc. River Amazons.

Obs. This kind of capsular covering is, so far, unique, and renders the whole structure of the statoblast as remarkable as it is beautiful under microscopic observation.

Parmula*.

Gen. char. Globular or elliptical, fusiform when growing round the small immersed branches of trees. Structure coarsely reticulate, extremely hard and rigid, rising into thorn-like processes on the surface. Colour light green. Skeleton-spicule acerate, curved, fusiform, abruptly sharp-pointed, smooth. Statoblast globular, large, more or less tubercular on the surface; aperture infundibular; crust composed of granular microcell-substance (Pl. V. fig. 2, *a*), charged with and surrounded by minute, spinous, acerate spicules (fig. 1, *g*, and 2, *d*), limited by a layer of parmuliform spicules (fig. 2, *b*, *c*) both internally and externally, the former in contact with the chitinous coat (fig. 1, *e*), and the latter on the surface of the crust† (fig. 1, *f*).

* *Parmula*, a little round shield.

† As these characters are taken from the only species yet known, they may hereafter have to undergo alteration.

1. *Parmula Batesii.*

(Pl. V. fig. 1, *a–i*, and fig. 2, *a–c*, also Pl. VI. fig. 15.)

Spongilla Batesii, Bk., No. 20, p. 21, pl. xxxviii. fig. 12.

More or less globular when growing round the small immersed branches of trees one inch or more in thickness. Structure coarsely reticulate, extremely hard and rigid, rising into thorn-like processes on the surface. Colour light sea-green. Skeleton-spicule curved, fusiform, abruptly sharp-pointed, smooth (Pl. VI. fig. 15), forming, when bundled together with the hard transparent sarcode, the rigid structure above mentioned, charged throughout with statoblasts. Statoblast large, globular, more or less uniformly tuberculated (Pl. V. fig. 1). Aperture infundibular (fig. 1, *h*). Crust very thick, composed of granular microcell-structure of a white colour, which, growing out through the interstices of the reticular arrangement of skeleton-spicules, reduced in size, which form a capsular covering to the statoblast, gives it the tuberculated character mentioned (fig. 1, *d*), charged with and surrounded by minute, thin, curved, fusiform, gradually sharp-pointed, spinous acerates irregularly dispersed throughout its substance (fig. 1, *g*, and 2, *d*), limited, both inside and outside, by a layer of parmuliform spicules, the former in contact with the chitinous coat (fig. 1, *e*), and the latter on the free surface of the crust, giving it a light brown colour (fig. 1, *f*). Parmuliform spicule circular, flat, infundibuliform, terminating in a point, like a little round shield turned up at the margin, which is even (fig. 2, *b*, *c*), arranged both internally and externally in juxtaposition, more or less overlapping each other, with the funnel-shaped process *outwards* in both instances, so that the surface of the crust is covered with little points (fig. 1, *f*).

Loc. River Amazons.

Obs. The double layer of statoblast-spicules, viz. one on the inner and the other on the outer side of the crust, is seen also in *Spongilla nitens.*

2. *Parmula Brownii.*

Spongilla Brownii, Bk., No. 20, p. 19, pl. xxxviii. fig. 11.

Globular, four or more inches in diameter, appended to a small twig rather than embracing it. Structure and colour the same as in the foregoing species. Skeleton-spicules the same, but diminished to half their size round the statoblasts, to which they afford a distinct capsule. Statoblast globular; aperture slightly infundibular; crust thin, composed of microscopically minute spherical cells, irregularly agglomerated together, so as to produce small lacinuliform processes, which

project into the interspaces between the capsular spicules; unaccompanied by the spinous spicule, which is present in the foregoing species, and without a continuous layer of the parmuliform spicule over the surface, but presenting one in contact with the chitinous coat, where it is overlain by an extremely thin development of the microcellular crust, from which the lacinuliform processes above mentioned are projected.

Loc. British Guiana (*Schomburgk*). British Museum, general collection. Running no. 527.

Obs. The most remarkable part about this species is the cell-structure of the crust, which is just a transition in size from that of *Spongilla Carteri* and *S. nitens* to the minute granular form of *Parmula Batesii* &c., thus showing that the latter is also composed of minute cells, which, as before stated, require a power of 450 diameters to be resolved. Thus with *Tubella reticulata* and *Parmula Batesii* we possess three of those species with extremely rigid reticulated structure which as yet have only been found in the river Amazons, but to which the provisional genus "*Uruguaya*," as will presently be seen, also appears to be allied.

Uruguaya, n. gen. prov.

1. *Uruguaya corallioides.* (Pl. VI. fig. 17.)

Spongilla corallioides, Bk., No. 20, p. 22, pl. xxxviii. fig. 13.

Irregularly digitate; rising into a polychotomous and anastomosing mass of cylindrical branches, which may attain several inches (7 or more) in all directions. Colour faint whitish yellow or dark leaden on the surface, internally white or colourless. Surface even, vitreous in appearance, extremely hard, smooth, and compact, interrupted by small raised vents more or less uniformly distributed at short and unequal distances from each other. Internal structure composed of short densely reticulated fibre, formed of the skeleton-spicules of the sponge in bundles firmly united together by colourless sarcode, which, together with the spicules, in a dried state simulates, from its hardness and vitreous appearance, an *entirely* silicified mass. Skeleton-spicule very robust, much curved, cylindrical, rounded at both ends, smooth or microspined, about six times longer than it is broad (Pl. VI. fig. 17). Statoblast unknown.

Loc. "Rapids" of the river Uruguay, above the town of Salto, Uruguay.

Obs. This is a most interesting species in almost every particular. 1st. Some of the specimens of it that have been

sent to England are very large. 2nd. That sent by Mr. George Higgin to his brother, Mr. Thomas H. Higgin, F.L.S., of Liverpool, the former took from the "rapids" of the river Uruguay, above the town of Salto, "200 or 300 miles" from the sea in the delta of the Parana; in which "rapids" the amount of water is subject to such great alteration in quantity that, when Mr. Higgin found it, the stream was confined to the "cracks in the rock," while when he returned to the spot again it was "40 feet deep." The specimen sent to Liverpool is still adherent to the piece of rock on which it grew; and all the other specimens of the sponge that Mr. Higgin saw at this spot were of the same kind. 3rd. In none of the specimens sent to England has the statoblast been seen, or any other trace of reproductive organs, although the size of the specimens evidences full growth, and the circumstances connected with them, viz. their presence in a river subject to great alteration in the size of the stream, and at a great distance from salt water, supply all that is required for a genuine freshwater sponge. 4th. The characters of the sponge above given are unique, although the hardness and rigidity of the skeletal structure seems to find a kinship with that of *Tubella reticulata* and *Parmula Batesii* &c., from the river Amazons, as before intimated, if not also with *Spongilla nitens*, whose locality is at present unknown.

With reference to the "leaden" colour of the surface, it is worthy of remark that this is not only confined to the surface, fading off into the white structure of the interior a little below it, but in the *same* branch may abruptly meet the faint whitish-yellow colour which the whole sponge may present on other occasions. The cause of this diversity in colour must be explained by future observation.

Of the specimens of this sponge known to me, one is in the Museum of the Royal College of Surgeons, which Dr. Bowerbank states is labelled "near Salto Grande, above Paysandu," presented by Mr. W. Bragge (No. 20, p. 23); but when Dr. Bowerbank adds that this place is on a tributary of the upper part of the river Amazons, it is evidently a mistake; for Salto and Paysandu are on the river Uruguay. Another specimen is in the British Museum, labelled "Freshwater sponge from Paraguay. Presented by R. McAndrew. Register no. 72. 11. 13. 1; running no. 622." A third is in the Liverpool Free Museum, viz. that sent to his brother by Mr. George Higgin, to which I have alluded; and a fourth is part of a specimen sent by Dr. Garland of Dublin to the same museum, which differs from all the rest in being of a faint yellow-white colour *throughout*, with an accumulation of minute brown

bodies here and there on the surface towards the base, which are the capsules of one or two undescribed species of the vorticellate infusorian "*Freia*," that cannot be confounded with the statoblasts (for they would be large enough to be seen with the naked eye, and situated in the interior).

Fulfilling all the other characters of a freshwater sponge, I cannot help thinking that a specimen will be found sooner or later in which the presence of the statoblast will complete them. At the same time, if we are right in identifying the statoblast with the winter-egg of the freshwater Polyzoon, that flustraceous Indian species which I have long since described and illustrated under the name of *Hislopia lacustris* ('Annals,' 1858, vol. i. p. 169, pl. vii.) has not, to my knowledge, been found to possess them; so it is not impossible that this may be the case with *Uruguaya corallioides*, of which I therefore make "provisionally" a new genus. The specimens mentioned have been carefully examined by different people over and over again; but in no instance has a trace of a statoblast been found, with the exception of that noticed by Dr. Bowerbank (No. 20, p. 23), which, I think, admits of much doubt, not so much of the existence of the "fragment" as of its belonging to *Uruguaya corallioides*.

Observations.

Although my classification is chiefly based upon the form of the spicules of the statoblast, yet it is not to be assumed that I have included all the species of the Spongillina that have been discovered, but those only in which this means of classification has been obtained, as will be seen by the following short summary of Dr. W. Dybowski's elaborate account of freshwater sponges from Lake Baikal, in Central Asia (No. 32).

The specimens were obtained by his brother Dr. Benedict Dybowski and Herr W. Godleuski while in Siberia, and have been divided into four species, with their varieties respectively, under the generic name of "*Lubomirskia*," after Prince Wladislau Lubomirski, thus—*L. baicalensis*, Pallas, sp., *L. bacillifera*, n. sp., *L. papyracea*, n. sp., and *L. intermedia*, n. sp.; in all of which the statoblast (gemmula) was absent; so that, whatever arrangement is made of them hereafter, the present one must rest upon their general form and that of their skeleton-spicule respectively, which places them much in the same position as the two original species (viz. *S. fluviatilis* and *S. lacustris*) before the spicules of their statoblasts were discovered.

Lubomirskia baicalensis.

Lubomirskia baicalensis, Pallas (apud Dybowski, No. 32, p. 11, Taf. i. fig. 1), with four varieties, viz. *α*, *β*, *γ*, *δ*.

One learns from the figure of this species (*op. cit.* Taf. i. fig. 1), which is half the natural size, that it consisted of long digital processes, about 14 inches by $\frac{1}{2}$ an inch in their greatest diameters, more or less uniformly inflated at short intervals (that is, bullate), but solid throughout. Structure elastic, but not crumbling between the fingers. Colour dark grey or olive-green. Skeleton-spicule curved, fusiform, gradually sharp-pointed, spiniferous generally, but especially towards the ends, particularly in the variety *γ*, where the rest of the shaft is smooth (Pl. VI. fig. 19).

Loc. Lake Baikal.

Largest skeleton-spicule 0·222 by 0·021 millim. "Parenchyma-spicule" (? early form of the foregoing) 0·159 by 0·006 millim., a smooth thin acerate (fig. 19, *a*).

Lubomirskia bacillifera.

Lubomirskia bacillifera, n. sp. (No. 32, p. 22, Taf. i. figs. 2, 4, 5, and 6, &c.), with three varieties, viz. *α*, *β*, *γ*.

Massive, more or less lobed. Structure much the same as that of the foregoing species, but finer and softer. Colour grass-green. Skeleton-spicule curved, cylindrical, sometimes fusiform (as in the variety *β*), round at the ends, and spiniferous generally, but more particularly over the ends, sometimes (as in the varieties) smooth over the rest or middle of the shaft (Pl. VI. fig. 20).

Loc. Lake Baikal.

Largest skeleton-spicule 0·270 by 0·024 millim. Parenchyma-spicule a small, thin, smooth acerate. No measurement.

Lubomirskia intermedia.

Lubomirskia intermedia, n. sp. (No. 32, p. 28, Taf. iv. fig. 3, A, spicule only), with one variety, viz. *α*.

Flat, spreading. Structure like that of *L. baicalensis*, but more tender. Colour yellowish or olive-green. Skeleton-spicule curved, fusiform, gradually sharp-pointed, spiniferous generally (Pl. VI. fig. 21).

Loc. Lake Baikal.

Largest skeleton-spicule 0·222 by 0·018 millim. Parenchyma-spicule a large smooth acerate. No measurement given.

Lubomirskia papyracea.

Lubomirskia papyracea, n. sp. (No. 32, p. 33, taf. i. fig. 7 &c.).

Papyraceous in thinness, with smooth shining surface. Structure very soft. Colour white. Skeleton-spicule thick (seven times longer than broad), curved, cylindrical, round at the ends, thickly spiniferous throughout (Pl. VI. fig. 22).

Loc. Lake Baikal.

Largest skeleton-spicule 0·144 by 0·018 millim. Parenchyma-spicule a very small smooth acerate.

Obs. The "parenchyma-spicule" appears to be the same in each of these species, and therefore is probably merely an early form of the skeleton-spicule, and not a "flesh-spicule," which it is hardly to be supposed would be the same in all four.

Observations.

Besides the new species of freshwater sponges in Lake Baikal, Dr. Dybowski mentions the occurrence of *Spongilla lacustris* in a small lake at its western end, called the "Pachabicha See," together with a new species, viz. *S. sibirica* (No. 32, p. 66), which is not described; also the occurrence of *Spongilla lacustris* in the Goktscha See in Transcaucasia, in the Dnieper, Minsk, Livonia, and about Warsaw and Charkow; also *Ephydatia* (*Spongilla*) *fluviatilis* in Livonia, Warsaw, and Charkow; besides *Trachyspongilla erinaceus* (No. 28 and No. 32, Taf. 4. fig. 13 *a*), *Spongilla erinaceus* (No. 32, p. 33), ? *Spongilla erinaceus*, Ehr.

Thus it is evident from what has been above stated that freshwater sponges have been found in many parts of Europe, in Asia, and in the two Americas; but, to my knowledge, no notice has been made public of their occurrence in Africa; still it may be fairly inferred that new species will be discovered there as well as elsewhere; and a yet further inference may be drawn, viz. that we are only on the threshold of our knowledge of the extent and varieties of the Potamospongida generally, so vast are the freshwater areas that have not been explored for this purpose.

Ehrenberg in his 'Mikrogeologie,' 1855, Taf. 1–12, represents many amphidisks (birotulates) which he found in "freshwater deposits" of various parts of the world, several of which are quite different in form from those with which we are acquainted.

Lastly, I would observe that, although I have endeavoured to make the above communication immediately useful, it is by no means intended to supply what can only be obtained by a careful perusal at leisure of all that has been written on the subject, especially that to which I have referred.

EXPLANATION OF THE PLATES.

N.B.—1. All the figures of the statoblasts are drawn to the same scale, viz. 1-24th to 1-1800th inch, in order that their constituent parts may appear under the same magnifying-power. They, however, are to a certain extent diagrammatic for the sake of clearness, inasmuch as all the coats are of course *in contact* naturally; the chitinous coat, which is represented by the *dark* line, is not quite so thick and the spicules are not quite so scanty as they are represented; but, generally speaking, the whole may be considered *relatively* magnified on the scale above mentioned.

2. All the "more magnified" parts or spicules are drawn to the scale of 1-12th to 1-6000th inch.

3. The skeleton-spicules, viz. figs. 14–18, are drawn to the scale of 1-12th to 1-1800th inch, and the rest, viz. 19–22, on much the same scale, having been traced off those done with Hartnack's no. 4, prism and objective (No. 32, p. 69).

4. Fig. 13, *f*, is only magnified three diameters.

5. It should be remembered that all sponge-measurements, both general and elementary, can only be considered approximative; for what is fixed upon as a standard at one time may be upset by the measurements of another, chiefly on account of the objects appearing under different degrees of development in different specimens. Still there is an average largest size and shape of the spicule which can easily be recognized: but this too is subject to differences; for it may be thick or thin, although *fully developed*, while the former is the shortest and the latter the longest. Thus varieties are numerous; but the great point is to give the average shape and size of the fully-developed object, and to avoid as much as possible the variations; for the latter confuse, while a very slight acquaintance with sponge-structure points out that their existence may be inferred in all cases.

Plate V.

Fig. 1. *Parmula Batesii.* Perpendicular section of the statoblast through the aperture, showing:—*a*, cavity filled with germinal matter; *b*, coat enclosing the same; *c*, chitinous coat; *d*, crust; *e*, internal layer of parmuliform spicules; *f*, external layer of the same; *g*, minute spinous acerate spicules; *h*, aperture; *i*, nipple-like prolongation of *b*.

Fig. 2. The same. More magnified view of fragment of crust bearing two parmuliform spicules: *a*, crust, to show granular appearance of microcellular structure; *b*, parmuliform spicule, end view; *c*, the same, lateral view; *d*, more magnified view of spinous acerate spicule.

Fig. 3. *Spongilla nitens*, n. sp. Perpendicular section of the statoblast through the aperture: *a*, cavity filled with germinal matter; *b*, coat enclosing the same; *c*, chitinous coat; *d*, crust composed of columns of hexagonal cells in the section, in juxtaposition; *e*, inner layer of spinous acerates; *f*, external layer of the same; *g*, aperture; *h*, nipple-like prolongation of *b*; *i*, more magnified view of cell-structure of crust; *k*, the same of spinous acerate.

Fig. 4. *S. navicella*, n. sp. Perpendicular section of the statoblast through the aperture: *a*, cavity filled with germinal matter; *b*, coat enclosing the same; *c*, chitinous coat; *d*, layer or capsule composed of minute navicelliform acerates (no appearance of crust-substance); *e*, aperture; *f*, nipple-like prolongation of *b*; *g*, more magnified view of navicelliform spicule.

Fig. 5. *S. multiforis*, n. sp. External view of entire statoblast: *a*, chitinous coat; *bb*, layer of minute spinous acerate spicules (crust almost obsolete); *c c c c c*, apertures; *d*, more magnified view of spinous acerate.

Fig. 6. *Meyenia plumosa*. Perpendicular section of the statoblast through the aperture: *a*, cavity filled with germinal matter; *b*, coat enclosing the same; *c*, chitinous coat; *d*, crust; *e*, birotulate spicules *in situ*; *f*, aperture; *g*, nipple-like prolongation of *b*; *h*, birotulate spicule, more magnified; *i*, disk, end view; *k*, stellate form of flesh-spicule.

Fig. 7. *Tubella recurvata*. Perpendicular section of the statoblast through the aperture: *a*, cavity filled with germinal matter; *b*, coat enclosing the same; *c*, chitinous coat; *d*, crust; *e*, tubelliform or trumpet-like spicules *in situ*; *f*, capsule of equal-ended denticapitate spicules *in situ*; *g*, aperture; *h*, nipple-like prolongation of *b*; *i*, more magnified view of tubelliform spicule; *k*, the same of equal-ended denticapitate spicule; *l*, still more magnified end view of head of same.

Plate VI.

Fig. 8. *Tubella reticulata*. Perpendicular section of the statoblast through the aperture: *a*, cavity filled with germinal matter; *b*, coat enclosing the same; *c*, chitinous coat; *d*, crust; *e*, trumpet-like spicules *in situ*; *f*, aperture; *g*, nipple-like prolongation of *b*; *h*, more magnified view of trumpet-like spicule; *i*, the same of large disk, end view; *k*, the same of small disk, end view; *l*, small spinous skeleton-spicule forming a capsular layer to the statoblast; *m*, skeleton-spicule smooth or sparsely spined; *n*, more magnified view of *l*.

Fig. 9. *T. spinata*, n. sp. Perpendicular section of statoblast through the aperture: *a*, cavity filled with germinal matter; *b*, coat enclosing the same; *c*, chitinous coat; *d*, crust; *e*, trumpet-shaped spicules *in situ*; *f*, aperture; *g*, nipple-like prolongation of *b*; *h*, more magnified view of trumpet-shaped spicule with spinous shaft; *i*, large disk; *k*, small disk, denticulated, end view; *l*, the same, still more magnified, lateral view; *m*, flesh-spicule, spinous acerate.

Fig. 10. *T. paulula*: *a*, trumpet-shaped spicule, lateral view; *b*, large disk, end view; *c*, another form of the trumpet-like spicule. Scale 1-12th to 1-6000th inch.

Fig. 11. *Meyenia fluviatilis*: *a*, birotulate spicule, lateral view; *b*, denticulated disk, end view. Same scale.

Fig. 12. *Tubella anonyma*, n. sp. External view of statoblast of unknown sponge: *a*, striated coat; *b*, reticulated structure resting on the same; *c*, aperture; *d*, reticulated structure, more magnified, to show that it is composed of minute, erect, conical bodies in relief on the striated coat, having a spicule in the middle of the interstice; *e*, more magnified lateral view of spicule; *f*, fragment of coat of germinal matter, showing polygonal reticulation.

Fig. 13. *Spongilla Lordii*. Lateral view of entire statoblast: *a*, body or chitinous coat; *b*, neck, ending in *c*, aperture; *d*, coating of acerate spicules; *e*, more magnified view of spicule; *f*, group of statoblasts *in situ*, magnified three diameters.

Fig. 14. *S. lacustris*. Skeleton-spicule, to show the "gradually-pointed" form.

Fig. 15. *Parmula Batesii.* Skeleton-spicule, to show the "abruptly-pointed" form.
Fig. 16. *Tubella reticulata.* Skeleton-spicule, to show "rounded end."
Fig. 17. *Uruguaya corallioides.* Skeleton-spicule, to show micropunctation and "rounded" ends.
Fig. 18. *Spongilla nitens.* Skeleton-spicule, to compare with foregoing form.

Characteristic skeleton-spicules of freshwater sponges from Lake Baikal, after Dr. W. Dybowski; traced off the figures in Taf. iv. (No. 32), drawn with Hartnack's prism and no. 4 objective.

Fig. 19. *Lubomirskia baicalensis,* Pallas: *a,* "parenchyma-spicule," after Dybowski.
Fig. 20. *L. bacillifera,* n. sp.
Fig. 21. *L. intermedia,* n. sp.
Fig. 22. *L. papyracea,* n. sp., two forms.

X.—*Spolia Atlantica*: *Contributions to the Knowledge of the Changes of Form in Fishes during their Growth and Development, especially in the Pelagic Fishes of the Atlantic.* By Dr. C. F. Lütken.

[Continued from p. 14.]

8. Brama, Taractes, Pterycombus, Pteraclis.

With regard to *Brama*, it is to be remarked, in the first place, that it has been ascertained that *B. Raji* is not an almost exclusively Mediterranean species, but a bathyphilous and very cosmopolitan species, which is spread from the Färöes to the Cape, and represented at Chili, New Zealand, and Japan by very nearly allied, if not identical forms (*B. japonica*, Hilg., appears to be a distinct species), but has not yet been found among the Antilles or on the eastern coast of America. Leaving out of consideration some young forms (*B. Orcini*, *B. Dussumieri*) which cannot pretend to the rank of distinct species, a series of species from the Antilles, Madeira, &c. have subsequently been described, some with smooth scales, others, as in *Pteraclis* and *Pterycombus*, with a large spine upon the anterior margin of the visible part of each scale, and a corresponding notch in the posterior margin of the immediately preceding scale. It is a singular thing that it has not hitherto been observed that *B. Raji*, when young but yet about half-grown (290 millims.), has the scales armed with the same spines, which do not disappear until the fish approaches its full development. We are therefore not justified in forming a separate genus (*Taractes*) for the species of *Brama* with spines, nor in determining the young individuals furnished with spines (*Taractes asper*, *Brama Orcini* and